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ABSTRACT

Described is the state of the art of technology in special education. Considered are such issues as the gap between invention and innovation, the need for technological applications, and promising developments (including computer applications and sensory compensation devices). The role of learning resource centers in bridging the gap between invention and actual classroom use is examined. (CL)

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"Technology and Media for Handicapped Learners: Looking Ahead"

A paper presented at the Annual Council for Exceptional Children Convention, Atlanta, Georgia as a part of a session entitled, "Media Technology and Educational Programming for the Handicapped"

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The February issue of the Phi Delta Kappan journal had imprinted on its cover in bold red letters this question: "Will Technology Revolutionize Education?" Just inside on the editor's page William Cunningham wrote on "The Need for Dialogue between Educators and Technologists." This was followed by a lead article entitled "Via Technology to a New Era in Education" and then comments by eighteen educators, some of whom placed considerable faith in the ability of technology to make significant and positive changes in education, while others took a more skeptical point of view. A review of popular educational journals and programs of educational conventions over the past decade leaves little doubt but that a keen level of interest exists regarding the prospect of technology being able to come to the aid of educators as we work to solve some very difficult problems. For the special educator working with handicapped children and youth, the promise of technological innovation is even more enticing. Civil rights for the handicapped as embodied in the general acceptance of equal educational opportunity for all demands that we capitalize upon the best that technology can offer. Dean Jamison, Patrick Suppes and Stuart Wells (1974) said it well: "The key to productivity improvement in every economic sector has been through the augmentation of human efforts by

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technology, and we see no reason to expect a different pattern in education" (p. 57). And yet, as I will point out in a moment, we have not embraced technology in education to an extent consistent with earlier predictions.

By "technology," or more precisely, by "instructional technology" I mean more than the hardware alone. I like one of the definitions offered by the Commission on Instructional Technology: Instructional technology "...is a systematic way of designing, carrying out, and evaluating the total process of learning and teaching in terms of specific objectives, based on research in human learning and communication, and employing a combination of human and nonhuman resources to bring about more effective instruction" (Tickton, 1970, p. 21).

What is the state of the art regarding technology in special education as viewed by a few educators interested in this area of concern?

The Past and the Present

Twelve years ago Ed Blackhurst wrote an article for Exceptional Children in which he discussed the implications of technology in special education (Blackhurst, 1965). While the applications he suggested at the time seem relatively easy to develop and implement when compared to achievements in space or medical technology for example, the state of the art in 1977 does not appear to be all that different from 1965.

CEC sponsored a national conference on "Instructional Technology in the Education of Exceptional Children" in 1970 (McDonald, 1971). Most of the applications described in that conference were unsophisticated, although pragmatically applicable. The surprising observation is that if this same conference were held today that the program would include the same limited applications.

Norris Haring wrote in 1970 that educational technology was being applied in two ways: "1) through automated and non-automated media for display and measurement as part of the task of instruction, and 2) as a set of procedures which systematize instruction (Silverman, 1968)." It is my observation that in this decade we have made the greater gains in the second application, that is, we have applied the parameters of systematic instruction to the classroom setting. We have been less successful in adopting as practice the utilization of nonhuman resources to improve education.

Professor Cunningham (1977), in assessing the state of the art with regard to educational technology, makes an interesting comparison with an industrial model developed by Gibson and Nolan (1974) at the Harvard Business School. Within the business world they observe four stages of growth as technological applications, especially the use of computers, are implemented. These stages of growth are initiation, expansion, formalization, and maturity. William Cunningham is probably correct when he says that educational technology is only at stage one, the initiation stage. We are experiencing the phenomena characteristic of interjecting something new and different into a system.

Robert Barr (1977), Professor of Education at Indiana University, believes that schools are basically the same today as they were fifty years ago and it is not because the technology for positive change is not there, but because we just haven't been successful at implementation. Frank Withrow (1976), in writing about educational technology for the handicapped essentially makes the same point: While we are an information-rich society we have failed to organize the resources so that they reach the classroom.

I picked up a monograph from the world of business the other day which dealt with the topic "The Coupling Problem in Technological Innovation" (Brown, 1976). The first sentence read as follows: "One of the major concerns facing management today is that of the under-utilization of potentially good new ideas"

(p. 3). The author went on to say that the basic problem is not the generation of new ideas, but getting them into the system where they can be implemented. Drop the word "management" and replace it with "education" and the truth is not altered.

Why the Gap between Invention and Innovation?

Innovation is a complex problem. All too often, I believe, we educators have sometimes acted as if innovation was really pretty simple: just help people become aware of new developments in technology and they will rush forward to embrace them. Not so, as actual experience demonstrates over and over again. If we define innovation as "...an improvement which is measurable, is the result of deliberate choice and development, is durable and unlikely to occur frequently" (Morrish, 1976, p. 24) we have a common starting point for trying to ascertain why there is a gap between inventions and their dissemination. I would like to suggest four possible reasons for this gap: (1) Education is essentially a conserving institution, (2) educators often perceive technology as a threat to both their jobs and their personal interaction with children, (3) the cost is high, and (4) the vehicles to bridge the gap between technological inventions and innovation and yet to be fully developed.

1.) Education as a conserving institution.

William Norris (1977) believes that there is a definite tendency for educators to reject advances in educational technology because of extreme conservatism and institutional inertia, among other reasons. It is risky to make changes in an institution so open to public view. No doubt this explains the caution with which local districts approach anything that might possibly lead to criticism by the community and why federal agencies back off when it appears that Congressional concern is being generated.

2.) Technology perceived as a threat.

When technological applications are proposed, educators often fear disruption. "Job-displacement anxieties appear; some people become concerned over doing old jobs in new ways; and others fear a loss of personal identity with their work" (Gibson and Nolan, 1974, p. 80). So write Professors Gibson and Nolan in discussing technology in the business sector; the same anxieties appear in education. Norris (1977) counters these concerns with a view that technology can have just the opposite effect: it actually allows teachers to spend more time with individual students and opens new opportunities for new and rewarding positions.

3.) High costs.

The costs associated with public education is one of the major concerns facing state and local district administrators today. With a fixed level of resources, there seems to be little left over for the selection and purchase of media, much less for larger expenditures for high cost technological innovations. We are familiar with EPIE's data that only about 1% of school budgets are spent on instructional materials, teachers spend less than 1% of their time in selecting materials, yet materials are used to structure about 95% of classroom teaching and learning experiences (EPIEGRAM, 1976). With this small dollar amount available for purchase of materials, it is not difficult to realize that even less is left over for the development of courseware. James Popham (1977) believes that private industry has demonstrated that they can't afford the high costs involved in development and that the federal government has pulled back in their efforts along these lines. Thus, the lack of dollars becomes a real factor in the wide gap between invention and innovation.

4.) Lack of vehicles to bridge the gap.

If these first three reasons are true, that is educators are essentially hesitant to move ahead with innovations, that technology is perceived as a threat, and if high costs hinder development, then perhaps we need some type of bridging vehicle. It seems to me that we must set in place more individuals with the capability of serving as agents of change. Some do exist. NCEMMH and the ALRC's have been able to serve this function to a limited extent and they can continue to work in this role. They have been limited in their mission, however, by meager budgets when compared to the costs involved in serving heterogenous populations spread throughout large geographical areas, and realizing the complexities involved in making change.

The Need for Technological Applications

In the decade ahead, it appears to me that the need for educational technology will become increasingly apparent. This prediction is based upon several observations.

1.) Because of the movement of children from restricted environments to less restrictive ones, and because the public schools are charged with providing a free and appropriate education to all children, we are facing an influx of children with learning problems into the mainstream of education. If a truly appropriate education is to be provided for each child, teachers must be supported by a technology that will permit them to deal with a vast range of individual differences. A teacher can't "wing it" with a few textbooks and a ditto machine.

2.) Because of a commitment to provide appropriate educational experiences to the the severely handicapped population, we are finding it necessary to take advantage of advances in instructional technology in order to ameliorate the conditions of learning that have for so

long hindered achievement among the severely involved.

3.) Because of an awareness that technology can be utilized to compensate for sensory impairments. The translation of print to a tactual mode and sound to a visual mode are two examples that can be mentioned. The optacon, or an equivalent device may become a part of what we include among the resources required to provide a free and appropriate educational experience for blind children.

4.) Because we cannot manage the load imposed by the implementation of an individual educational program (IEP) for every handicapped pupil without the help of technology. If we are to actualize the concepts implied in P.L. 94-142, we must be able to assess children in a wide range of skills and under all sorts of conditions, state objectives in behavioral terms, match needs to curricular materials, analyze and sequence learning tasks, locate and obtain the proper media, evaluate and report performance, and on the basis of feedback make appropriate program revisions. All this will require applications of computer technology as we will be so bogged down in paper work that little instruction will actually occur.

5.) Because the pressure is on the educational system to increase productivity even as the prices of inputs have been rising. Technology holds promise for such rise in educational productivity when measured in terms of learner achievement.

Promising Developments

There are a number of promising developments in the application of technology to the needs of handicapped children and youth, each of which exemplifies a way in which we can expect to move a step closer to equal educational opportunities for all children. Let me suggest just a few.

1.) Computer applications. Computers are being used both to manage

instruction (CMI) and to assist in direct instruction (CAI). CMI is the most relevant and immediate application of computer technology to the handicapped. The Wisconsin System of Instructional Management (Dagnon and Spuck, 1977) is designed to store and process test and observational data, and provide achievement profiles and diagnostic reports. These reports are then used to identify instructional needs and selecting appropriate experiences and resources. Ken Cross and others at the State University College at Buffalo have also been successful in developing systems to manage the instructional process (Cross and Clayback, 1976).

Research with CAI has indicated both a saving in student time in learning tasks and when used as a supplement to regular classroom instruction, it leads to improvement in achievement, particularly for slower students (Jamison, Suppes, and Wells, 1974). CAI has been used effectively with deaf students and with mentally retarded children. The biggest roadblock to the greater use of CAI is the high cost of developing courseware. Hardware costs continue to decline, but the investments in software development are not being made.

2.) Video applications. You have already heard today about some developments in adapting television in order to make it a relevant vehicle for educating deaf students. It seems safe to say that these uses will increase over the next decade because of their demonstrated success. Closed circuit television for enlarging print for the visually impaired, such as the Visualtek system, allows immediate access to the printed page. Interactive systems such as Ceefax allow a viewer to call up and read material off the video screen at will. The most exciting development is in videodisc technology. Up to 300 books averaging 250 pages each can be stored on one side of a 12-inch videodisc and played back as both image and sound (Wood and Stephens, 1977). The cost will be about one cent per minute. MCA Disco-Vision has a contract

with the federal government to develop an optical videodisc player that can be used for high-density information storage and retrieval, with freeze-frame capability, and reproduction of hard copy of the frozen still made off of the tube. The possibilities for classroom use with the handicapped seem endless as one considers the potential of the videodisc system.

3.) Sensory compensation devices. The Kurzweil Reading Machine is one example of what is to come as we apply technology to the needs of the handicapped. This device converts printed words into synthetic speech and is now in the final field testing stage. The Sonicguide is a mobility aid that uses reflected ultrasound to detect obstacles. The optacon, a device that translates the printed word into a tactual format has already been mentioned. Speech output on calculators have also been available for some time, as have type-telephones for the deaf.

Conclusions

I have attempted to point out the need for greater application of technology to educational programs for the handicapped. The needs are evident and will become increasingly apparent in the decade ahead. There is a gap between what we know and what we have applied - between invention and innovation. We have examined some of the reasons for this gap, and have given several examples of how technology is being applied successfully.

In conclusion I would like to suggest how the gap might be closed more rapidly and how educational technology might become an even greater resource to handicapped learners. In my opinion the bridge between invention and innovation functions best when linking agents are available to respond to expressed needs at the local district level. Approximately 800 special education learning resource centers presently exist around the United States, many of

which are staffed by personnel with some knowledge of media and technology for the handicapped. The extent of their knowledge and the range of their capabilities to function as a linkage between what is needed and what is known is quite variable. Some are highly sophisticated and are able to direct educators to the newest and most appropriate applications in technology; others are only able to offer teachers an opportunity to view a few of the most common and least expensive materials. NIMIS is rapidly becoming a major resource to these learning resource specialists, but much more is required. In my opinion the federal government should design the NCEMMH/ALRC/SO system in such a manner that successful technological innovations for the handicapped are systematically disseminated through this system to the state and intermediate or local learning resource centers. At present the system lacks both the financial resources and federal authorization to identify exemplary practices and then to systematically move these innovations to the local level where they may be accepted, modified, or rejected according to local option. If, for example, a curriculum material or device is developed, rigorously tested, and marketed through the services of a Specialized Office and NCEMMH, then a part of the dissemination activities ought to include systematic training of ALRC personnel in the demonstration of that material or device followed by a plan to reach all of the state and local learning resource centers. At the present time dissemination occurs more by chance than by design.

The Division of Media Services of the Bureau of Education for the Handicapped is to be commended for their foresight in establishing the existing programs for developing and disseminating educational media and technological innovations for the handicapped. The key elements of a successful system are in place. What now remains to be done is to invest this system with the resources and the

charge to function as a bridge between invention and innovation. P. L. 94-142 requires each state education agency to describe programs and procedures for acquiring, disseminating, and adopting promising educational practices and materials derived from educational research and demonstration projects, and each local education agency to develop an individual educational program for every handicapped child, if these requirements are to result in meaningful educational experiences day-in and day-out, at least 180 days per year per child, then we must use the best that technology can offer to permit the teacher to reach every child, regardless of handicap. As I look ahead and attempt to predict the future of programs for the handicapped I see our biggest challenge in successfully bridging the gap between what is known on the one hand and what is actually available and practiced on the other. I am convinced that we are moving in the right direction and I believe that we can build and maintain those bridges!

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